

Let Me Imagine That for You

Citation for published version (APA):

Heller, J., Chylinski, M., de Ruyter, K., Mahr, D., & Keeling, D. I. (2019). Let Me Imagine That for You: Transforming the Retail Frontline Through Augmenting Customer Mental Imagery Ability. *Journal of Retailing*, 95(2), 94-114. <https://doi.org/10.1016/j.jretai.2019.03.005>

Document status and date:

Published: 01/06/2019

DOI:

[10.1016/j.jretai.2019.03.005](https://doi.org/10.1016/j.jretai.2019.03.005)

Document Version:

Publisher's PDF, also known as Version of record

Document license:

Taverne

Please check the document version of this publication:

- A submitted manuscript is the version of the article upon submission and before peer-review. There can be important differences between the submitted version and the official published version of record. People interested in the research are advised to contact the author for the final version of the publication, or visit the DOI to the publisher's website.
- The final author version and the galley proof are versions of the publication after peer review.
- The final published version features the final layout of the paper including the volume, issue and page numbers.

[Link to publication](#)

General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal.

If the publication is distributed under the terms of Article 25fa of the Dutch Copyright Act, indicated by the "Taverne" license above, please follow below link for the End User Agreement:

www.umlib.nl/taverne-license

Take down policy

If you believe that this document breaches copyright please contact us at:

repository@maastrichtuniversity.nl

providing details and we will investigate your claim.

Let Me Imagine That for You: Transforming the Retail Frontline Through Augmenting Customer Mental Imagery Ability

Jonas Heller^{a,*}, Mathew Chylinski^a, Ko de Ruyter^{a,b}, Dominik Mahr^c, Debbie I. Keeling^d

^a *UNSW Business School, University of New South Wales, Sydney, New South Wales 2052, Australia*

^b *King's Business School, King's College, WC2B 4BG London, United Kingdom*

^c *Department of Marketing and Supply Chain Management, Maastricht University, Tongersestraat 53, 6211 LM Maastricht, The Netherlands*

^d *School of Business, Management and Economics, University of Sussex, BN1 9SL Brighton, United Kingdom*

Available online 16 April 2019

Abstract

The rapid development of augmented reality (AR) is reshaping retail frontline operations by enhancing the offline and online customer experience. Drawing on mental imagery theory, this paper develops a conceptual framework to reflect how AR emulates customer's cognitive processes offloading those to the technology. Consequently, the AR-enabled frontline improves decision comfort, motivates positive WOM and facilitates choice of higher value products. The underlying mechanism is a sequential mediation via improved processing fluency and decision comfort. The findings also demonstrate boundary conditions of customers' visual processing styles and product contextuality. Object-visualisers benefit more from AR induced imagery processes, and the effect of processing fluency on customer decision comfort is moderated by product contextuality. The results are verified with repeat studies to control for novelty of AR, and a field study that highlights the impact of AR on customers' choice and spending. We discuss implications for theory and practice of AR-enabled frontline retailing.

© 2019 New York University. Published by Elsevier Inc. All rights reserved.

Keywords: Augmented reality; Customer frontline experience; Mental imagery; Processing fluency; Word-of-mouth intentions

Introduction

Advances in technology are rapidly transforming the ways in which retailers connect with their customers. Augmented Reality (AR) interfaces hold the unique potential for generating value through compelling buying experiences across existing and emerging retail channels (Rafaeli et al. 2017). AR allows for a digitally enhanced view of reality, overlaying it with information and visuals to support the decision-making process. For example, aware that their customers are often uncomfortable with making purchase decisions because they find it hard to imagine how the furniture would match with their décor (Joseph 2017), Wayfair and IKEA now offer AR-based online catalogues. These give customers the option of digitally placing, moving and recolouring realistic 3D models of furniture, such as

a coffee table, in their living room. Moreover, AR is increasingly used to address customer needs for additional visual product information for better informed decisions. For instance, the AR application KabaQ enhances restaurants' menu cards with virtual information about ingredients, calories or portion sizes. It allows customers to view 3D digital representations of menu options from multiple angles and sizes. Enabling an AR retail frontline is a distinct approach to facilitate product evaluation and encourage purchase by customers.

However, while many retailers are rapidly future-proofing their frontline operations by introducing AR interfaces (Table 1), customer uptake of AR remains surprisingly slow (Fink 2017). Retail customers can find it hard to imagine using AR applications (Morgan 2017). Customers also differ widely in their beliefs regarding the benefits of AR technology, or the extent to which they feel comfortable making use of those benefits (Hilken et al. 2017). Yet in today's hyper-connected marketplace, AR could provide truly distinctive retailing experiences that, importantly, customers are willing to share with peers (Vijayasaratthy 2004). Success in such markets partly depends on recommendations of other customers, and their experiences of engaging with technological innovations (Chakravorti 2004). Given the

* Corresponding author.

E-mail addresses: j.heller@unsw.edu.au (J. Heller),
m.chylinski@unsw.edu.au (M. Chylinski), ko.de_ruyter@kcl.ac.uk
(K. de Ruyter), d.mahr@maastrichtuniversity.nl (D. Mahr),
D.I.Keeling@sussex.ac.uk (D.I. Keeling).

Table 1
Augmented reality applications in retailing.

#	Company	Industry	B2C/B2B	Title	Launched	Device	Function	Imagery generation	Imagery transformation
1	Snap Inc.	Communication	B2C	Snapchat	2011	Phone / Tablet	Social messaging application for mobile devices that allows the exchange of stylized photos or videos (“snaps”), as well as text messages (“chats”).	Low	Low
2	Ribena	Communication	B2C	Doodle Your World	2017	Phone / Tablet	Adding humorous AR to videos and sharing videos with peers	Low	Low
3	Mr. Spex	Eye-wear	B2C	Virtual mirror	2011	Desktop / Webcam	Allows consumers to virtually try on sunglasses using their webcam, allowing life comparison of two models and sharing with peers	High	Low
4	Converse	Fashion	B2C	Converse shoe sampler	2010	Phone / Tablet	Virtual try-on of shoes	High	Low
5	Lacoste	Fashion	B2C	LCST Lacoste AR	2018	Phone / Tablet	Virtual try-on of shoes	High	Low
6	American Apparel	Fashion	B2C	AR American Apparel	2018	Phone / Tablet	Scan signage in-store and receive additional product information such as customer reviews, colour variants, and pricing	Low	Low
7	TopShop	Fashion	B2C	TopShop AR Mirror	2011	In-store mirror	Virtual try-on of products inside of the store	High	Low
8	Uniqlo	Fashion	B2C	Uniqlo Magic Mirror	2012	In-store mirror	Virtual try-on of products inside of the store	High	Low
9	Timberland	Fashion	B2C	Timberland AR Mirror	2014	In-store mirror	Virtual try-on of products facing outside of the store to make customers stop on the street	High	Low
10	Charlotte Tilbury	Fashion	B2C	Charlotte Tilbury Magic Mirror	2018	In-store mirror	Virtual try-on of makeup using facial scanning	High	Low
11	Dulux	Furniture / Home	B2C	Dulux Visualizer	2017	Phone / Tablet	Allowing consumers to change the colour of walls in their rooms and sharing the results with their peers	High	High
12	Home Depot	Furniture / Home	B2C	Project Colour App	2015	Phone / Tablet	Allowing consumers to change the colour of walls in their rooms and share pictures with your social network	High	High
13	Ikea	Furniture / Home	B2C	IKEA AR Catalogue	2016	Phone / Tablet	Enables consumers to place selected furniture in their own homes using augmented reality, allows taking pictures of the virtual furniture in the room and directly links to the web shop of IKEA	High	High
14	Magnolia market	Furniture / Home	B2C	Magnolia Market’s AR App	2018	Phone / Tablet	Enables consumers to place selected furniture in their own homes using augmented reality	High	High

Table 1 (Continued)

#	Company	Industry	B2C/B2B	Title	Launched	Device	Function	Imagery generation	Imagery transformation
15	Lowe's	Furniture / Home	B2C	HoloRoom	2016	AR Smart Glasses	Allows consumers to design their kitchen or bathrooms in real-size and change colour, shape and content of their designed rooms in real-time	High	High
16	Niantic	Gaming	B2C	Ingress	2013	Phone / Tablet	A location-based, augmented-reality game around a science fiction story in which players must join one of two forces to compete for territory	Low	High
17	Niantic / Nintendo	Gaming	B2C	Pokémon GO	2016	Phone / Tablet	A location-based, augmented-reality game in which players must catch digital creatures who appear on the screen as if they were in the same real-world location as the player	High	High
18	Yihaodian (largest Chinese online grocery retailer)	Groceries	B2C	Yihaodian Virtual Stores	2012	Phone / Tablet	Allows customers to experience virtual grocery aisles on their mobile devices and shop by tapping on the product instead of using web shop	High	Low
19	Ink hunter	Lifestyle	B2C	Ink Hunter	2016	Phone / Tablet	Augmented reality application to allow consumers to place virtual tattoos on their body to evaluate the look of it	High	High
20	Google	Online services	B2C	Google Translate	2015	Phone / Tablet	Allows instant translation of words and sentences by using the camera of the phone/tablet and overlaying foreign language detected with the language of the consumer's choice	High	Low
21	Microsoft	Online services	B2C / B2B	HoloLens	2016	AR Smart Glasses	Augments the windows operating system in the user's real world, allowing the placement of virtual layers in the user environment	High	High
22	Walgreens	Pharmaceuticals	B2C	Aisle 411	2014	Phone / Tablet	Augmented navigation through the pharmacy store, helping consumers to find the product they are looking for	Low	Low
23	Layar	Print	B2C	Layar	2014	Phone / Tablet	Augmented reality application which makes print media interactive by overlaying it with virtual features. Includes Geo Layers to discover nearby locations	Low	Low
24	Autodesk	Product development	B2B	Fusion 360	2016	AR Smart Glasses	Allows real-time interaction during the development process for designers in a shared, augmented workspace and real-sized modelling for designing robots, potentially reducing the numbers of prototypes needed	High	High
25	Stryker	Product development	B2B	ByDesign 3D	2016	AR Smart Glasses	Augmented collaboration design platform for the design of operating rooms	High	High
26	Trimble / SketchUp	Product development	B2B	SketchUp Viewer	2016	AR Smart Glasses	Allows interaction with augmented 3D models of architectural ideas to allow collaboration and visualisation aid during the design phase of architectural models	High	High

importance of offline and online word-of-mouth (WOM), it is disconcerting that a recent study reports that only a small number of customers consider AR applications ‘worth recommending’ (Rese et al. 2017, p. 314). So, there is a pertinent need for retailers to develop a better understanding of how AR-supported buying decisions instigate communication among retail customers, who share their experiences with others to accelerate positive reputation effects of this frontline technology.

To address this need, we draw on emerging theorizing on mental imagery. The central premise of this literature puts the customer’s imagination at the core of their decision-making. Customers engage in perceptual information processing based on “a mental event involving visualization of a concept or relationship” (Lutz and Lutz 1978, p. 611). When ordering a sofa, customers employ mental imagery to generate a representation in their mind’s eye and visualise the object (in various forms) in their living room (Phillips, Olson, and Baumgartner 1995). This ability to generate and transform images of products outside the immediate sensory experience drives much of customer information processing across different points-of-sale (Pearson et al. 2015). While imagination per-se may include audio (Zatorre 1999), touch (McAvinue and Robertson 2008), smell (Djordjevic et al. 2004), and taste (Sauvageot, Hoang Nguyen, and Valentin 2000), there is an ongoing debate whether mental imagery exists for all different sensory modalities (Schifferstein 2009). Most conclusive evidence has been gathered around visual imagery, which accordingly focuses the scope of our research (Babin and Burns 1997; Miller and Stoica 2016). Compeau, Grewal, and Msonroe (1998) argue that visualisation plays a central role in influencing consumer attitudes and behaviour. Conversely, lack of the ability to project a visual mental image may make customers uncomfortable with their choice or even withdraw from making a purchase decision (Luce et al. 2001; Simon 1955). Further, there is considerable heterogeneity with respect to mental imagery processing depending on situational (e.g., the degree of product contextuality) and personal (e.g., information processing style) contingencies (Petrova and Cialdini 2008).

A unique aspect of an AR-enabled retail frontline is its potential to ‘offload’ customer’s mental imagery processing during decision-making (Dror and Harnad 2008). Generating a digital 3D representation of a product, embedding and transforming it in a use context, are the fundamental affordances of AR (Azuma 1997). Evidence is emerging that AR’s ability to supplement aspects of mental processing facilitates complex decision-making, resulting in more comfortable choices (Isley, Ketcham, and Arent 2017). Yet, a gap exists in our understanding of a precise connection between affordances of AR and customers’ mental imagery processes. We do not know how this connection contributes to a retailer’s reputation building objectives by encouraging customers to share their experience and recommendation via positive WOM. Research is also needed to verify the same process can support near-term revenue goals by encouraging choice in a retail setting. This paper aims to address these issues while developing insight into specific boundary conditions that contribute to theorizing on how AR is shaping the

future of the retail frontline. Our research contributes in four specific ways.

First, we theorize the impact of AR-based mental imagery affordances on WOM intentions and verify their impact on customers’ product choices. We view WOM as a means towards shaping reputation success in an AR-enabled retail frontline, whereas customers’ choices are used to verify AR’s relevance for achieving near-term revenue objectives. Based on the central premise that in hyper-connected markets customers will embrace new technologies on the retail frontline if they believe that others do so as well, we focus on the critical need for WOM. Empirically disentangling AR’s capacity to substitute mental imagery enables the investigation of various configurations of the AR frontline, and sheds light on factors that contribute to the success of AR solutions in retailing. Second, we seek to uncover the mechanisms that underpin this process by examining imagery processing fluency (a measure of cognitive offloading) and decision comfort as sequential mediators. A series of experimental studies using real-life AR applications offers explanation of how customers offload mental imagery assisted by the AR technology. Third, we investigate two specific boundary conditions, customers’ visual processing style and product contextuality, to account for observed heterogeneity in WOM intentions related to the diffusion of innovative technologies (Namatame 2010). Last, we conduct a field experiment using the “Amazon–Shopping made easy” application to investigate the effect of the AR retail frontline on customers’ product choices and spending.

Conceptual Background

Mental Imagery

The ability to imagine, to generate mental images that reflect products and experiences, is an indispensable skill during customer decision-making (Pearson et al. 2015). Following Schifferstein (2009) we define a mental image as “an internally generated representation of an object, scene, or event”, and acknowledge that mental imagery is “a process by which visual information is represented in the working memory” (MacInnis and Price 1987, p. 473). Mental images are self-generated based on subjective mental processes. According to Schifferstein (2009) the generation of mental images can be derived from a range of auditory, verbatim or haptic stimuli, yet visual stimuli by far dominate during decision-making and consumption. Customers visually simulate the use of offerings to foresee consequences of use before purchase; they gain certainty about the relation of product attributes to satisfaction (Bar 2007; Phillips, Olson, and Baumgartner 1995). This provides an extended range of information fundamental to successful decision-making (Hassabis and Maguire 2007). Several studies suggest that imagining a product or service experience significantly impacts customers’ attitudes and behaviours (Escalas 2004; Roggeveen et al. 2015). For instance, Miller and Stoica (2016) show that mental imagery triggered by images in tourism advertising is the primary driver of behavioural intentions. Imagination is so central that customers might use imagination to

evaluate products, even if those products are not present on store shelves (Hirschman 1984).

Mental imagery helps explain functional as well as hedonic consumption experiences (Rodríguez-Ardura and Martínez-López 2014). Customers often use mental imagery to fill in missing information about products (Schwartz and Black 1999). By enhancing their information with mentally generated images of the product or its environment, customers build visual maps of potential consumption experiences (Hassabis and Maguire 2007). Customers also engage in mental comparison of potential outcomes of present actions, using counterfactuals. Customers might even go as far as mentally constructing narratives by, for instance, imagining the experiences of a holiday (Hettis et al. 2000). Researchers concur that mental imagery is at the core of decision-making (Bar 2007; Beatty et al. 2016), and pre-consumption evaluation would not be possible without imagination. Yet, few frameworks in marketing have consistently represented mental imagery in consumer decision-making. In Table 2 we summarize relevant literature on mental imagery.

Imagery Generation Through AR

A consensus among those who study mental imagery is that it consists of two distinct stages, namely imagery generation and imagery transformation (Kosslyn, Thompson, and Ganis 2006; Pearson et al. 2015;). Generation of mental images results from immediate perceptual information, which must be integrated into a meaningful context (MacInnis and Price 1987). Once mental imagery has been generated, it needs to be maintained because mental images are subject to “rapid decay with an average duration of only 250 ms” (Pearson et al. 2013, p. 6). In other words, a mental image is subject to distortion and disruption due to the depletion of attentional resources. Mental images also naturally fade quickly to avoid disruption to normal perception (Kosslyn, Thompson, and Ganis 2006). Working memory used for any form of imagery reduces the available capacity for other mental activities. Conversely, the quality and vividness of mental images suffers when cognitive load is high, resulting in less valuable information for the decision-making process (Keogh and Pearson 2014). Customers picture themselves trying out products, but also imagine additional information, such as which items from their wardrobe would complement a new pair of shoes (Escalas and Luce 2004). While the generation of visual mental imagery is subject to distorting influences, an important affordance of AR allows consumers to *digitally* generate a visual, lasting 3-dimensional (3D) product representation against the backdrop of the natural world. AR helps offload otherwise internalized cognitive processes onto the device. This offloading facilitates processing of complex visual information, such as a portion size of dessert options by “Kabaq AR”, and sustains those as long as is needed to make a decision.

Imagery Transformation Through AR

Once an image is generated, it can be transformed for further cognitive processing. Mental images are routinely transformed

in the mind, which is a process that occurs during everyday problem solving and creative thinking (Pearson, Rademaker, and Tong 2011). A widely studied aspect of visual mental transformation is mental rotation (Park, Stoel, and Lennon 2008). A well-known example is documented by Kirsh and Maglio (1994) who describe how participants offload their mental effort in a Tetris game by rotating Tetris blocks using a keyboard. These authors identify benefits of offloading as receiving new information, reducing cognitive efforts, and facilitating matching to the existing environment. Mental transformations can go beyond mental rotation to restructuring an object (Verstijnen et al. 1998), changing its size (Kosslyn 1975), re-colouring (Levine, Warach, and Farah 1985), or spatial relocation (Frick, Mohring, and Newcombe 2014). Further, customers perceive the ability to transform virtual objects in consumption situations as important (Zhu et al. 2007). A key affordance of AR allows customers to transform (e.g., rotate) digital content, which in turn assists visual imagery processes during decision making. AR can serve as a tool to offload cognitively demanding visual transformations in the working memory. Importantly, imagery transformation can only happen after the image has been generated. Eye-wear retailer Mr. Spex, for instance, encourages customers to try on digital sunglasses and do a 360° inspection of how they look whilst worn on a customer’s face. IKEA’s Place AR application encourages customers to move, resize and change the appearance of digital furniture in their homes. So, AR configurations differ in the way they combine manifestations of mental imagery generation and transformation.

Hypotheses Development

As the success of innovative frontline technologies hinges on how far a retailer’s reputation is shaped when customers share and engage in offline and online conversations about their experiences, it is critical to establish how AR impacts customer WOM. The reputation objectives of the AR-enabled retail frontline must also be sustained alongside near-term revenue objectives. Verifying that AR supports customers’ choices is an important corollary in our theorizing. Our premise is that different AR configurations vary in the extent to which they elicit WOM and choice, and that this depends on the extent to which they afford imagery generation and transformation. We show our conceptual model in Fig. 1.

We posit that the experience of digitally generating and transforming (vs. static) visuals will have a positive impact on WOM intentions and may make choices more appealing. In support, Yoo and Kim (2014) argue that mental imagery positively impacts a range of customer behavioural intentions. Further, experiential use of specific and quality visual imagery, even in the absence of physical interaction with a product, creates positive WOM (MacInnis and Price 1987; Miller and Stoica 2016). Being able to ease information processing by offloading mental imagery processes motivates WOM and likely supports choice. As positive WOM spreads, awareness grows among customers (Berger and Milkman 2018). In a hyper-connected marketplace, AR facilitates mental imagery that simulates a sense of direct experience with products. When the experience is vivid and

Table 2
Selected mental imagery literature.

Study	Context and method	Theory base	Mental imagery definition	Independent variables	Process variables	Boundary conditions	Dependent variables	Key findings
Research theme: impact of mental imagery on marketing outcomes								
Babin and Burns (1997)	Picture and mental imagery instructions are manipulated in a print ad context to measure effects on attitudes, experimental study	Mental imagery	Imagery is a process by which sensory information is represented in working memory	Pictures (concrete vs. less concrete), Mental imagery instructions (present vs. absent)	Vividness and elaboration of mental imagery	–	Attitudes towards the ad and the brand	Ads containing concrete pictures combined with the instruction to imagine lead to more positive attitudes. The effect is mediated by vividness and elaborateness of mental imagery
Escalas (2004)	Written advertisement manipulations to illicit narrative transportation, experimental study	Mental simulation	Mental simulation can be thought of as the cognitive construction of hypothetical scenarios	Mental simulation (Encouraged vs. not encouraged), Argument strength (weak vs. strong)	Narrative transportation, positive affect, critical thoughts	Mental simulation	Advertisement attitudes, Brand evaluations	Mental simulation persuades via narrative transportation, defined as immersion into a story. Transportation includes strong affective responses and low levels of critical thought, which, in turn, affect ad attitude and brand evaluations.
Lee and Gretzel (2012)	Website characteristics are manipulated to investigate the effect on mental imagery, experimental study	Mental imagery processing, narrative information processing	Mental imagery processing is defined as mode of information processing which includes sensory representations (images) in working memory that are used in the same way as perceptions of external stimuli	Website characteristics (type of text, type of pictures, presence of sound)	Mental imagery processing (Quantity, Modality, Vividness, Valence)	–	Attitude strength, attitude confidence & attitude resistance to counter-arguments	The mental imagery evoked by pictures on a website affects attitude strength, confidence and resistance to counter arguments. Mental imagery is an important element of persuasive communication.
Roggeveen et al (2015)	Static vs. dynamic presentation format of products/services, experimental study	Vividness theory, verbal imagery	Imagery is a mode of processing that evokes sensory experiences	Dynamic vs. static presentation format	–	Verbal imagery (prime), Decision involvement	Preferences & Choice	Dynamic presentation format increases involvement with the product/service experience. The result is an increased preference for and valuation of hedonic options

Table 2 (Continued)

Study	Context and method	Theory base	Mental imagery definition	Independent variables	Process variables	Boundary conditions	Dependent variables	Key findings
Schlosser (2003)	Object interactivity is manipulated in an online shopping context, experimental study	Cognitive elaboration, mental imagery	(1) all those quasisensory and quasi-perceptual experiences of which (2) we are self-consciously aware, and which (3) exist for us in the absence of those stimulus conditions that are known to produce their genuine sensory or perceptual counterparts, and which (4) may be expected to have different consequences from their sensory or perceptual counterparts	Object interactivity	Cognitive elaboration, Mental imagery	Shopping goal (search vs. browse)	Attitudes & Purchase Intentions	Object interactivity evokes vivid mental images of product use regardless of the users' goals and thus increase purchase intentions
Schlosser (2006)	Object interactivity is manipulated using a website, experimental study	Mental imagery, consumer learning	Not defined, we assume it is similar to Schlosser (2003)	Object interactivity	Encoding mental images, retrieving mental images	Imagery retrieval (encouraged vs. discouraged)	True & False memories, False positives, False negatives	Imagery-evoking tools (object interactivity) can enhance learning but can also increase false memories.
Yoo and Kim (2014)	Product presentation (text vs. pictures) is manipulated in an online shopping context, experimental study	Concreteness, mental imagery	Mental imagery is a mental activity that visualizes a concept or relationship and reflects the process by which sensory or perceptual experience is represented in an individual's working memory in terms of ideas, feelings, and memories	Product presentation (Pictures vs. texts)	Elaboration and quality of mental imagery	Style of processing (verbalisers vs. visualisers)	Emotions & Behavioural intentions	Mental imagery elicited from product presentation increased behavioural intentions via positive emotions. Visualizers experience greater elaboration of mental imagery than verbalisers when exposed to a concrete picture.
This study:	Investigating the effect of imagery offloading via AR modalities (imagery generation & transformation) on consumer choice and WOM	Mental imagery	A mental image is an internally generated representation of an object, scene, or event. Mental imagery is a process by which visual information is represented in the working memory.	AR imagery generation (low vs. high) and AR imagery transformation (low vs. high)	Processing fluency of mental imagery, Decision comfort	Style of visual processing (object vs. spatial visualisers) Product type (noncontextual vs. contextual)	WOM intentions, consumer choice and spending	Consumers can offload imagery processes on AR enabled devices. The increased processing fluency leads to decision comfort and, in turn, positive WOM intentions for the retailer as well as affecting consumer choice.

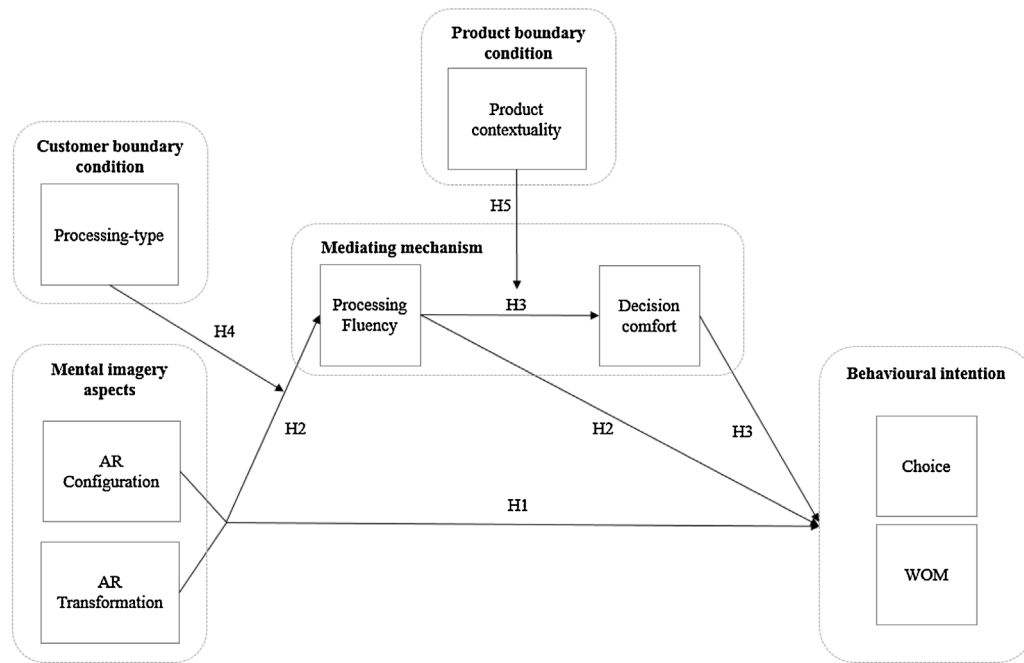


Fig. 1. Overall conceptual model.

exacting, we expect customers will be encouraged to share and recommend it to others. For example, PepsiCo launched the ‘Unbelievable’ campaign, which centred on an AR-enhanced bus shelter in London. The augmented experience at the AR-fitted bus-stop was a catalyst for excitement and discussion. WOM was the dominant response and customers shared their experiences across multiple social channels.

Our argument is that AR outperforms traditional media, such as printed catalogues or restaurant menus, due to its affordance for both the generation and transformation of 3D visuals. AR-enabled frontline applications have a stronger link to WOM than traditional media because more vivid experiences are easier to imagine and express. In hyper-connected markets customers’ main form of market participation (beyond consumption) is to share and express experiences with others. Researchers argue that this goes beyond validation of experience, and can become a reason for undertaking a consumption activity in the first place (Srivastava and Kaul 2014). When customers go to a restaurant; even before they taste any food, they will post an image of their desert on Instagram or Facebook. Since AR enables not only generation but also transformation of visual experiences, compared with static pictures like those used in product catalogues or menu items, we anticipate AR significantly substitutes visual processing (Paivio 2013). Our conjecture is that the degree to which AR-enabled frontline configurations support the joint elements of mental imagery (i.e., generating and transforming 3D imagery) will stimulate intentions for sharing of experience and impact retailer reputation via WOM. While imagery transformation (Petrova and Cialdini, 2008) requires a higher load on the cognitive system, imagery generation is requisite to engage in imagery transformation. Consequently, an interaction effect of imagery generation and transformation is hypothesized:

H1. The combined offloading of both imagery generation and transformation processes via AR will have a positive interaction effect on WOM intentions

Note that in H1, we anticipate a joint effect of mental imagery generation and transformation. Generation is a necessary stage of mental imagery that enables transformation. AR’s uniqueness lies in its emulation of these mental imagery processes, which distinguishes it from other forms of media that either lack generation (e.g., verbal description) or transformation (e.g., static pictures) currently dominating older forms of the retail front-line. A relevant corollary is that these AR’s affordances shape not only the long-term reputation via positive WOM but also near-term objectives of product choice and revenue generation.

There is mounting evidence that customer judgments and decisions are not only affected by the type and relevance of stimuli but also by the ease with which information can be processed (Petrova and Cialdini 2008). Processing fluency is relevant in how product-related information affects product evaluation and behaviour intentions (Wänke, Bohner, and Jurkowsch 1997). Processing fluency is the degree to which cognitive processing is effortless and reduces ‘thinking costs’ (Shugan 1980). Interestingly, participants find it easier to process information when asked to imagine a consumption situation based on visual as opposed to verbatim information (Kosslyn, Thompson, and Ganis 2006). Furthermore, increased fluency positively affects evaluative judgements of both products and experiences (Petrova and Cialdini 2008). This is empirically associated with a range of behavioural intentions in relation to brands (Lee and Baack 2014). AR offers the potential to overcome challenges associated with mental imagery, resulting from cognitive limitations, or information missing or distorted by traditional forms of retail frontline media. Having the ability to offload mental imagery processing onto the AR technology, effectively externalising

generation and transformation of mental images, allows for more fluent processing with a reduced cognitive load and a better customer experience.

Recent studies report that interactive, digitized cues positively influence imagery processing, resulting in easier access of relevant information for customers that increases processing fluency (Lee and Gretzel 2012; Schlosser 2003). Whilst insightful, it is important to understand the conceptual difference between interactive experiences and AR's abilities to offload transformation of AR generated visual mental imagery. That is, interactivity represents the ability to 'use' a digital object as you would a physical version of the same object (e.g., click a button on a camera to take a picture). Transformation represents the altering of an object, such as rotation, colour, shape, size or location. Thus, AR offers customers the ability to offload both interaction and transformation processes onto a device that should ease the processing fluency during decision making. Hence, we hypothesize:

H2. The positive interaction effect between imagery generation and transformation on WOM intentions will be mediated by processing fluency.

Note that in H2, transformation may drive the hypothesized interaction effect on processing fluency. As processing fluency reflects cognitive offloading, which prioritises effort, it likely responds to the mental load that tends to be higher during imagery transformation (Park, Stoel, and Lennon 2008). Following H1, we assume that generation is requisite for imagery transformation, yet Collins and Kimura (1997) suggest that a bulk of the cognitive effort is exacted by imagery transformation. Consequently, we anticipate that the interaction effect may be skewed towards transformation.

Recent studies (e.g., Dacko 2017) show that customers seek added value from AR interfaces beyond experiential benefits like playfulness (e.g., Pokémon Go). In both off- and on-line settings, retailers emphasize the importance of customer comfort by focusing on a smoother, easier purchasing process. Increased comfort in turn affects customer experience and behavioural intentions (Sweeney, Hausknecht, and Soutar 2000). Decision comfort is the degree of psychological (and physiological) ease, contentment and wellbeing one feels in relation to a specific decision (Parker, Lehmann, and Xie 2016). Decision comfort is particularly meaningful for AR frontline technologies. Mental imagery, the theoretical underpinning of AR, is often associated with ease of interpretation and quicker, more intuitive understanding of product information. In contrast to traditional media, vividly generated and transformable AR content offers a processing style more closely linked to the final consumption experience. Seeing a lifelike AR image of a dessert on your plate, or a couch in your living room, which you can rotate and inspect from every angle as with a real product, represents a large proportion of how customers actually enjoy products. The familiarity of the processing style during decision-making with end-consumption experience boosts comfort in the AR-enabled retail frontline.

The increased realism at reduced cognitive cost offered by the AR-enabled retail frontline likely causes customers to feel

more at ease with a decision (Schubert and Koole 2009). In our context, where customers share experiences and recommendations driven by hyper-connected markets, improving the comfort of a decision experience likely enhances intention to communicate and share that experience. Thus, we argue that the joint impact of imagery generation and transformation on WOM is a process of sequential mediation; where AR affordances of mental imagery lead to processing fluency, which impacts decision comfort, resulting in improved WOM. Thus, we hypothesize:

H3. The positive interaction effect of imagery generation and transformation on WOM intentions will be sequentially mediated by processing fluency and decision comfort.

However, this intricate process may not suit all customers equally. There is considerable variation as to how customers acquire and use (visual) information in purchase decisions (Paivio 2013). Kozhevnikov, Kosslyn, and Shephard (2005) identify two ways in which content can be visualized: (1) object processing refers to perceptual handling of object properties (e.g., shape or colour); (2) spatial processing refers to 3D properties of mental imagery (e.g., locations and spatial relations). Individuals differ in their capacity to process objects or spaces (Collins and Kimura 1997). Moreover, object and spatial processing are mutually exclusive capabilities enabling individuals to be classified into two distinct visualizer groups (Kozhevnikov, Kosslyn, and Shephard 2005). Given the prominence of transformation in AR, we expect that customers who excel in spatial processing derive less benefit than those who are more prone to object processing. Conversely, object visualisers derive more benefit from processing mental imagery as AR helps to overcome processing barriers. We hypothesize:

H4. The positive interaction effect between imagery generation and transformation on processing fluency will be stronger for object visualizers.

Whether an AR-enabled retail frontline is viable, may depend not just on the type of customer, but also on product category. For easy to evaluate products, customers often refrain from deliberative cognition and are less susceptible to the evaluation context (Zhao, Hoeffler, and Zauberman 2011). However, for products that require an evaluation context, such as furniture, cognitive effort is required to evaluate not only the product features but also their relation with the context (Weathers, Sharma, and Wood 2007). Specifically, it is harder to assess explicit probabilities and outcomes of contextual product options, as these depend on an association with similarly functioned products in a consumption environment. Extant studies shown that it is difficult for customers to visualize the detailed process of consuming contextual leading to less favourable evaluations (Dahl and Hoeffler 2004; Wänke, Bohner, and Jurkowsch 1997). We posit that as a result, customers will experience higher levels of decision comfort in the case of contextual products. Conversely, for non-contextual products (e.g., dessert options) customers are likely to experience lesser benefits from AR-enabled mental imagery, as task complexity is low and products are easier to evaluate (Parker, Lehmann, and Xie 2016). Hence, we hypothesize:

H5. The positive relationship between processing fluency and decision comfort is moderated by product contextuality, such that it will be stronger for contextual products.

Study 1: The Mediation by Processing Fluency and Decision Comfort on WOM Intentions in an AR Offline Service Frontline Interaction

To investigate H1, namely that AR can support aspects of the customer's mental imagery process and increase WOM intentions, we employed between-subjects experimental design. To support mental imagery as an underlying theoretical construct behind WOM intentions, we argue that customer's processing fluency reflects improved experience in an AR-enabled retail frontline. Greater processing fluency should sequentially lead to higher decision comfort in order to positively affect WOM intentions. We therefore examine the role of processing fluency (H2) and its sequential effects on customer's decision comfort (H3) in the context of AR-enabled experiences (Fig. 1).

Participants and Design

A sample of 304 students (50.2% female; average age = 20.25, range 18–25) were compensated for participating with extra credit on an undergraduate course. We used a 2 (AR imagery generation: low vs. high) \times 2 (AR imagery transformation: low vs. high) between-subjects design with processing fluency of mental imagery and decision comfort as covariates.

Measures

Across all studies, WOM intentions serve as our dependent variable. The scale (borrowed from Zeithaml, Berry, and Parasuraman (1996)) measured WOM intentions towards the frontline interaction that the customer experiences. Participants rated their WOM intentions using seven-point Likert scales ("strongly disagree" = 1 to "strongly agree" = 7) on three items, such as "I would say positive things about [the restaurant/the web-store] to other people" ($\alpha = .93$). Processing fluency of mental imagery was measured with a one-item scale by Wänke, Bohner, and Jurkowsch (1997): "How would you describe the process of imagining how the dessert would look like" on a seven-point Likert scale (1 = "extremely difficulty" to 7 = "extremely easy"). From Parker, Lehmann, and Xie (2016), we used a six item scale ($\alpha = .81$) to measure decision comfort (e.g., "I was satisfied with my experience of deciding which option to choose"), based on seven-point Likert scales (1 = "strongly disagree" to 7 = "strongly agree"). Choice was measured by asking participants to choose one of the six desserts they just had viewed, or by not choosing any of the displayed desserts (no-choice option). Refer to web Appendix A (in Supplementary Material) for all measures.

Materials and Procedure

Upon entering the room in which the experiment took place, participants were informed about the experiment process and

filled-out a pre-survey on a computer. The survey randomly distributed the participants to one of the four conditions and offered information that explained the task of the experiment. All participants received the same instructions to imagine they are in a restaurant and just finished their main course. The waiter (a research assistant) would then bring them the dessert menu. The participant's task was to decide between the six desserts offered. Participants could take as much time as they needed to decide including a no-choice decision. We controlled for participant's 'hungeriness', which did not result in any effects on chosen dessert or WOM intentions between the conditions.

In the *low* AR imagery generation configuration, participants received a dessert menu and a mobile tablet running an AR application that allowed the tablet's camera to scan the menu. The physical menu showed the name and one static picture for each dessert. When pointed at the specific menu item, on the tablet's screen participants received augmented information such as dessert ingredients and price. In the *low* AR imagery generation \times *high* imagery transformation condition, participants could transform the augmented information by using the touch-screen and clicking on the virtual content, which opens a 3D model of each dessert on a black screen. In the *low* AR imagery generation \times *low* imagery transformation participants saw augmented information but could not transform it in any way.

For the *high* AR imagery generation configuration, participants received only a mobile tablet (no physical menu) running an AR application that virtually placed digitized replicas of each dessert on the table. Next to the digitized replica, participants receive the same information about ingredients and price to keep information constant across our manipulations. In the *high* AR imagery generation \times *high* AR imagery transformation condition, participants could use the tablet touch-screen to rotate (by swiping left or right) and resize (pinching with two fingers) the virtual content. In the *high* AR imagery generation \times *low* imagery transforming condition, participants could only view the digitized replicas, but not transform them in any way, as the touchscreen of the device was disabled (see web Appendix B in Supplementary Material for stimuli). Participants then rated their WOM intentions.

Manipulation Checks

To assess our AR imagery generation manipulations, participants rated a four-item measure (AR imagery generation: e.g., "Using the augmented reality app allows me to see how the dish would look in reality") on a seven-point Likert scale ("strongly disagree" = 1 to "strongly agree" = 7). Principal components analysis and reliability checks reveal that the measure is a reliable one-component construct (AR imagery generation $\alpha = .93$). The manipulation checks performed as expected. Participants in the high imagery generation condition recognized higher imagery generation than those in the low condition ($M_{\text{generation High}} = 6.18$ vs. $M_{\text{generation Low}} = 4.35$, $t(302) = 12.412$, $p < .001$). An ANOVA analysis for the imagery generation manipulation check results in an insignificant effect of imagery transformation ($F(1,302) = .589$, $p > .1$) as well as an insignificant interaction effect of imagery generation and

imagery transformation ($F(1,302)=2.192, p>.1$). We created a six-item measure to assess imagery transformation (e.g., “Using the augmented reality app allows me to manipulate the virtual information about the product”), resulting in a one-component construct (AR imagery transformation $\alpha=.84$). The imagery transformation manipulation checks showed significant differences between the high and low manipulations ($M_{transformationHigh}=5.12$ vs. $M_{transformationLow}=3.88$, $t(302)=45.021, p<.001$). An ANOVA analysis for the imagery transformation manipulation check results in an insignificant effect of imagery generation ($F(1,302)=2.112, p>.1$) as well as an insignificant interaction effect of imagery generation and imagery transformation ($F(1,302)=.616, p>.1$).

Moderated Mediation Analysis

To investigate H1, we used the PROCESS macro (Hayes 2017, Model 1) with a simple effects parameterization. PROCESS Model 1 regresses WOM on imagery generation, imagery transformation, and their interaction. We found a significant AR configuration \times imagery transformation interaction effect on WOM ($\beta=.662, p=.026$), see Fig. 2. No significant main effects of AR configuration or imagery transformation emerged. However, in the high AR imagery generation condition, participants with high (versus low) imagery transformation reported significantly higher WOM intentions ($M_{generationHightransformationHigh}=5.56$, $M_{generationHightransformationLow}=4.96$, $t(300)=4.99, p<.05$).

To test for simple mediation of processing fluency (H2), we analysed our model with PROCESS v3.0 (Model 8), regressing imagery generation \times imagery transformation and their interaction on processing fluency and WOM intentions. Processing fluency was also regressed on WOM intentions. We find significant results for our mediating hypothesis, as the interaction effect of imagery generation \times imagery transformation no longer has a significant direct effect on WOM ($\beta=.315, p=.212$) but significantly predicts processing fluency of mental imagery ($\beta=.715, p=.030$). We do not find significant main effects of imagery generation ($\beta=.046, p=.850$) or imagery transformation ($\beta=-.092, p=.698$) on processing fluency. Supporting our hypothesis, our bootstrapping procedure (bias corrected, 5000 sub-samples) resulted in a significant indirect effect of imagery generation on WOM intentions for the high imagery transformation condition ($\beta=.370$, 95% CI: .146, .600) but not for the low imagery transformation condition. The index of moderated mediation is significant, resulting in moderated mediation ($\beta=.347$, LCI=.027, UCL=.672). [Please see web Appendix C (in Supplementary Material) for the corresponding 2×2 ANOVA results (Fig. 3).]

Moderated Sequential-mediation Analysis

The regression results supporting H2 and H3 are displayed in Table 3. We used PROCESS v3.0 to modify Model 6 to calculate the sequential-mediation analysis including the interaction effect of imagery generation \times imagery transformation (Hayes 2017). The imagery generation \times imagery transforma-

tion interaction predicts processing fluency ($\beta=.714, p=.030$) and WOM ($\beta=.450, p=.019$). Processing fluency also positively affects decision comfort ($\beta=.140, p<0.01$) and WOM ($\beta=.361, p<.01$); and decision comfort has a positive effect on WOM ($\beta=.914, p<.01$), resulting in partial sequential-mediation of the interaction effect via processing fluency and decision comfort. Supporting our hypotheses, a bootstrapping procedure (bias-corrected, 5000 sub-samples) resulted in a significant indirect effect of imagery generation through processing fluency on WOM ($\beta=.260$, 95% CI: .101, .460) for the high imagery transformation, but not in the low imagery transformation condition (95% CI: $-.162, .175$) (H2). We found a sequential indirect effect of imagery generation through processing fluency and decision comfort on WOM in the high imagery transformation condition ($\beta=.102$, 95% CI: .036, .210) but not in the low imagery transformation condition (H3). The index of moderated mediation for the indirect effect of imagery generation \times imagery transformation through processing fluency and decision comfort on WOM intentions is significant, resulting in moderated sequential-mediation ($\beta=.102$, LCI=.005, UCL=.220). Also, confirming our results from our moderated mediation analysis, we find a significant moderated mediation index for the indirect effect through processing fluency on WOM intentions ($\beta=.347$, LCI=.027, UCL=.672).

Corollary Choice Analysis

AR technology that affects a retailer's reputation via WOM may have implications for customers' choices and the prices they pay based on those choices. We analysed the choices participants made when selecting one of the six available desserts. Prices displayed on the dessert menu were taken from the original restaurant our AR holograms were based on (four of the desserts were priced at USD \$12 and two were priced at USD \$24; refer to web Appendix D (in Supplementary Material) for pictures of the desserts). The corollary analysis is designed to verify our earlier finding that reputation via AR in the form of WOM complements a retailer's short-term revenue objective. We coded no-choice with a revenue of \$0 and report the percentage of no-choice in each condition in web Appendix E (in Supplementary Material). A 2×2 ANOVA with imagery generation and transformation as factors and dessert price as dependent variable shows a marginally significant interaction effect on the price of the chosen dessert ($F(1,300)=2.848, p=.093$, $\eta^2=.009$). Testing the effect on the no-choice option, a binary logistic regression shows a significant interaction effect of imagery generation and transformation that suppressed no-choice behaviour ($b=-1.471, p<.05$, $\exp(b)=.230$, LCI=.062, UCL=.847). There were no significant main effects.

Discussion

The results support H1, and further confirm processing fluency as the underlying driver of WOM intentions. Its effect mediated the interaction effect of imagery generation and imagery transformation on WOM intentions (H2). We also find support for our predictions by showing that processing fluency

Table 3

Results study 1–4: unstandardized coefficients are shown. Significance based on two-tailed tests.

Independent variables	Study 1			Study 2			Study 3			Study 4 (replication study)		
	Processing fluency	Decision comfort	WOM	Processing fluency	Decision comfort	WOM	Processing fluency	Decision comfort	WOM	Processing fluency	Decision comfort	WOM
Constant	4.477**	4.647**	1.224**	4.775***	3.322**	1.334**	4.778***	5.750**	0.816	3.751***	4.550***	−0.49
Imagery generation	0.0458	0.306**	0.293	1.651***	−0.134	−0.199	–	–	–	–	–	–
Imagery transformation	−0.921	−0.2315	1.358	–	–	–	1.022***	0.501	0.357	3.206***	−1.102	0.334
Imagery generation × Imagery transformation (H1)	0.714*	0.377	0.450*	–	–	–	–	–	–	–	–	–
Processing style	–	–	–	0.02	−0.034	0.009	–	–	–	0.218	−0.055	0.066
Embedding	–	–	–	–	–	–	0.542	−0.296	−0.994	–	–	–
Imagery transformation × processing Style (H4)	–	–	–	−0.141*	0.095	−0.035	–	–	–	−0.342†	0.196	−0.29
Embedding × imagery transformation × product contextuality	–	–	–	–	–	–	−1.342*	0.078	−0.163	–	–	–
Product contextuality × processing fluency (H5)	–	–	–	–	–	–	–	.241**	0.137	–	.241†	0.137
Product contextuality	–	–	–	–	–	–	−1.502***	−1.842**	−0.291	0.059	−1.663*	0.254
Processing fluency (H2)	–	0.140**	0.361**	–	0.369***	0.349***	–	0.285	−0.037	–	.276***	−0.037
Decision comfort (H3)	–	–	0.914**	–	–	0.453***	–	–	0.834**	–	–	0.970***
R ²	0.047	0.175	0.537	0.16	0.197	0.403	0.398	0.281	0.433	0.151	0.35	0.53
MSE	2.032	0.4588	0.91	1.493	0.921	0.917	1.074	0.578	0.944	1.952	0.742	1.098
F	4.91**	12.661**	48.771**	14.808***	14.329***	31.329***	19.443**	7.188**	10.087**	3.352**	8.360***	21.22***
df	300	298	296	234	233	233	206	202	198	94	93	94

* $p < .05$.** $p < .01$.*** < 0.001 .† $p < 0.1$.

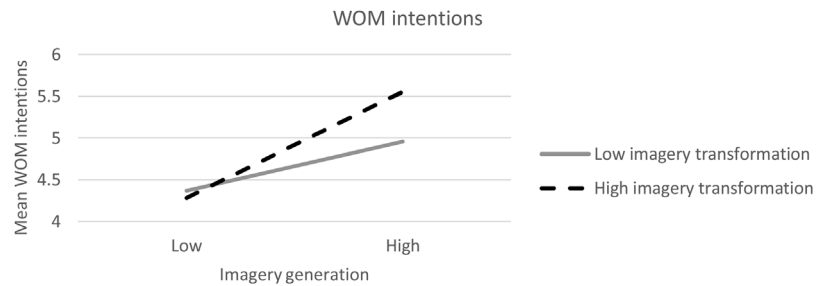


Fig. 2. Study 1 – effects of AR imagery generation with low or high AR imagery transformation on WOM.

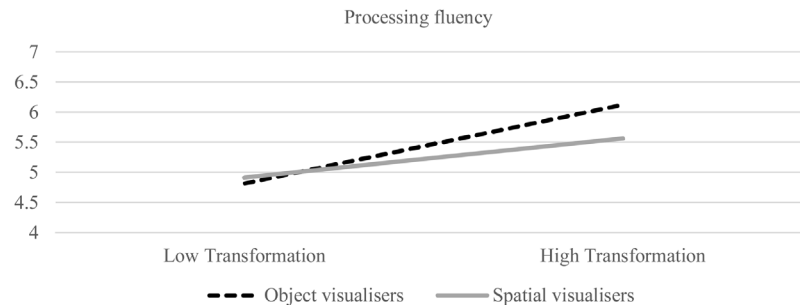


Fig. 3. Study 2 – AR imagery transformation x processing style interaction effects on processing fluency.

leads to an increase in reported decision comfort. Decision comfort emerges as the strongest predictor of WOM intentions confirming our predictions for sequential mediation (H3). Thus, AR's benefit on decision comfort stems from its ability to emulate mental imagery processes, which improves processing fluency when a customer can offload these mental processes to an AR-enabled frontline device. On the revenue side, the effect of AR on decision comfort also explains the increase in choice engagement of participants when assessing their choices. Even though the effect on dessert prices is only marginally significant, the high imagery generation x high imagery transformation group is significantly less likely to select a no-choice option using the AR retail frontline.

Study 2: Customer's Processing Style as a Boundary Condition in an AR Online Frontline Context

As not all customers may respond equally to the AR-enabled retail frontline, customer heterogeneity is an important boundary condition. In Study 2, we investigate the moderating effect of customer processing style, specifically visual processing style (object-visualizers vs. spatial-visualizers), on processing fluency (H4). As AR imagery generation and AR imagery transformation duplicate in online channels, Study 2 extends the results from the previous study in an *online* retail context to confirm the underlying process across channels.

Participants and Design

We recruited 259 participants via Amazon Mechanical Turk (MTurk) restricted to US participants with a HIT approval rate higher than 95%, and who completed more than 100 HITs successfully. Participants were informed that they could only take

the survey on a computer (not a phone or tablet) and that their Flash Player had to be updated prior to taking part. Otherwise we removed participants. Further, we removed participants who: indicated technical or task-related difficulties (9); failed attention checks (6); provided incomplete responses (2). We also removed univariate outliers (4). This resulted in a final sample of 238 participants (48.3% female, median age range = 25–34).

We employed an online survey in which participants were tasked with accessing a web store. They could browse the available product options and choose one of the products. Participants were instructed that after they click the “Buy now” button for one of the products, they would be redirected to our survey. We focused on customer processing styles and held AR imagery generation constant. That is, all participants were presented with a *high* imagery generation condition, while we manipulated imagery transformation between participants. To do this, we developed two different web-stores. In each store, customers saw 3D models of desserts (same models as in Study 1). These were shown contextually on a table, so-called embedded AR (Hilken et al. 2017). In the *high* imagery transformation condition, participants were able to rotate the 3D models on the table using the mouse, whereas in the *low* imagery transformation conditions participants could not.

Materials and Procedure

To measure customer's visual processing style, participants receive an established test called “The Measure of Ability to Rotate Mental Images (MARMI)” which asks participants to rotate an unfolded drawing of a cube (see web Appendix F in Supplementary Material) (Pérez-Fabello, Campos, and Meana 2014). High scores on the test indicate that the customer relies on spatial instead of object visualisations. We measured choice

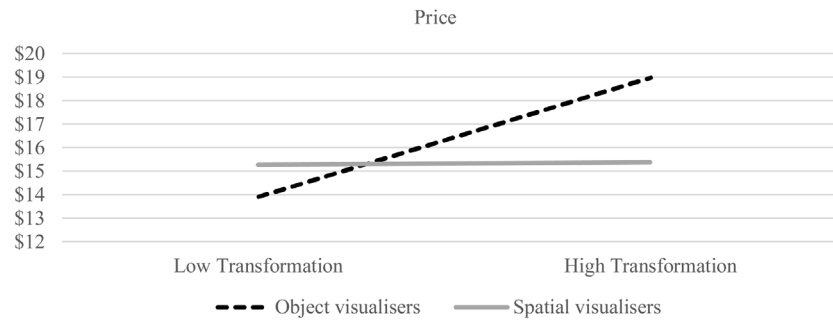


Fig. 4. Study 2 – imagery transformation x processing style effects on product price.

by letting participants choose one of three desserts shown on the website. We used the same measures for decision comfort ($\alpha = .85$) and WOM ($\alpha = .93$) as in the previous study.

Manipulation Checks

We employed the same manipulation checks as in Study 1 to test the imagery transformation manipulations and found significant differences between the two web-stores in line with our expectations ($M_{\text{transformation High}} = 5.60$ vs. $M_{\text{transformation Low}} = 4.30$, $t(236) = 7.341$, $p < .001$).

Moderated Sequential-mediation Analysis

To analyse H4, we use the SPSS PROCESS v3.0 macro and 5000 bootstrapping samples, and results supporting H4 are displayed in Table 3. We used PROCESS v3.0 to modify Model 6 to calculate the sequential-mediation analysis including the interaction effect of imagery transformation x processing style on processing fluency, as none of the pre-defined PROCESS models allows us to test these hypothesized relationships (Hayes 2017). The imagery transformation x processing style interaction predicts processing fluency ($\beta = -.141$, $p = .041$). We used a spotlight analysis to investigate the moderating effect of “spatial visualisers” (+1 SD) and “object visualisers” (−1 SD). For object visualisers, transformation has a significant and large effect on processing fluency ($\beta = 1.304$, $t(234) = 5.808$, $p < .001$; 95% CI: .862, 1.747). For spatial visualisers, we also find a positive, but less strong, effect ($\beta = .650$, $t(234) = 2.888$, $p = 0.042$; 95% CI: .206, 1.093). A floodlight analysis reveals a Johnson-Neyman significance region value of 7.954 (unstandardized), which corresponds to a region 86.55% of the sample and below. [Please refer to the web Appendix G (in Supplementary Material) for the full reporting of the analysis.]

Processing fluency also positively effects decision comfort ($\beta = .369$, $p < .001$) and WOM ($\beta = .349$, $p < .001$); and decision comfort positive effects WOM ($\beta = .453$, $p < .001$), resulting in partial sequential-mediation. We estimated the indirect effects on WOM using bootstrapping procedure (bias-corrected, 5,000 sub samples) resulting in a significant positive indirect effect of imagery transformation through processing fluency on WOM ($\beta = .416$, 95% CI: .267, .589) for object visualisers, but not for spatial visualisers ($\beta = .171$, 95% CI: −.026, .381). We also found a sequential indirect effect of imagery transformation

through processing fluency and decision comfort on WOM for object visualisers ($\beta = .169$, 95% CI: .088, .263) but not for spatial visualisers ($\beta = .067$, 95% CI: −.010, .160). The index of moderated mediation for the indirect effect of imagery transformation x processing style through processing fluency and decision comfort on WOM intentions is significant, resulting in moderated sequential-mediation ($\beta = -.024$, LLCI = −.051, ULCI = −.001).

Corollary Choice Analysis

Participants could choose among three desserts in Study 2. We reduced the number of desserts from six to three due to technical limitations of embedding holograms on our websites. PROCESS Model 1 was used to regress imagery transformation, processing style and their interaction on our dependent variable – dessert price. We find a significant direct effect of transformation on the price of the chosen dessert ($\beta = 7.705$, $p < .001$) as well as a significant interaction effect ($\beta = -1.070$, $p < .001$) (see Fig. 4). The conditional effects for −1SD, Mean and +1SD show that transformation significantly impacts price for the −1SD and Mean condition (−1SD: $\beta = 5.069$, $p < .001$; Mean: $\beta = 2.584$, $p < .001$) but not for the +1SD condition ($\beta = .099$, $p > 0.1$). A floodlight analysis reveals a Johnson-Neyman significance region value of 5.821 (unstandardized), which corresponds to a region 63.45% of the sample and below. The conditional effects are significant up to a processing style value of 5.821 ($\beta = 1.476$, $p = .05$) and insignificant above.

Discussion

With Study 2, we show that the underlying process linking AR configuration with WOM intentions (H1–H3) holds across channels online. Building on this result, we demonstrate that processing fluency of object visualisers benefits more from imagery transformation than the processing fluency of spatial visualisers (H4). Sequentially, this results in higher decision comfort and WOM intentions for object visualisers, even though spatial visualisers do not respond negatively to AR induced imagery transformation. In addition, we show that imagery transformation drives the choice for higher priced desserts, especially for object visualisers while not impacting the choices for spatial visualisers.

Study 3: Product Contextuality as Boundary Bondition in an Online Frontline Context

Not all products may suit an AR-enabled retail frontline equally, consequently product type may be an important boundary condition. We argue that mental imagery load might differ between products that require association with similarly functioned products to inform evaluation and those that do not. In Study 3, we explore this aspect of product contextuality in relation to the AR-enabled retail frontline. The design followed that of Study 2, with the important distinction that we did not measure visual processing style, and in addition to product contextuality we included a manipulation of embedding of AR information. This allowed us to confirm that embedding is a pre-requisite for AR in a retail context (Hilken et al. 2017). In the previous two studies we assumed embedding and included it as an underlying condition of the AR-enabled retail frontline. However, for due diligence, in Study 3 we add a condition that allows us to test this assumption and verify that it holds in our context. Especially in online settings, managers might overlook the importance of embedding so it is important to verify its relevance for AR in retail frontline.

Participants and Design

We investigated the potential moderating effect of product contextuality in our current model. For the 2 (AR imagery transformation: low vs. high) \times 2 (embedding: low vs. high) \times 2 (product contextuality: noncontextual vs. contextual) between-subject design we recruited 232 Amazon Mechanical Turk (MTurk) participants. We removed participants who: indicated technical or task-related difficulties (11); provided incomplete responses (3); and also removed univariate outliers (4). This resulted in a final sample of 214 participants (52.8% female, median age range = 25–34).

Pre-testing for Product Contextuality & Product Price

We pre-tested several products on how much context is required to evaluate. We asked 50 participants recruited via Amazon Mechanical Turk (MTurk) to rate pictures of products on a white background on the importance of context (“How important is it for this product to be evaluated in its use/consumption context?”, 5-point Likert scale) and the usefulness of seeing the product online in the consumption context (“How would you rate the usefulness of the use/consumption context for this product”, 7-point Likert scale). We found the biggest significant difference between furniture (arm-chairs) and food (desserts) for context importance ($M_{\text{Furniture}} = 4.01$, $M_{\text{Food}} = 2.83$, $t(98) = 2.854$, $p < .01$) as well as context usefulness ($M_{\text{Furniture}} = 5.06$, $M_{\text{Food}} = 4.24$, $t(98) = 2.672$, $p < .01$). We used the same desserts and associated prices for the choice analysis. As we did not have prices available for the furniture items, we used another MTurk panel ($n = 58$) to rate the three chosen chairs on their willingness to pay to get reasonable price estimates for the products. Participants saw all three chairs in a randomized order and used a sliding scale (0–250 USD) to

indicate their willingness to pay. The resulting means for each chair are \$39.79, \$36.04, and \$99.52, which we used as the price values associated to consumer choices for our corollary choice analysis.

Materials and Procedure

We followed a similar design as in Study 2 and created 8 different web-stores given our 2 (AR transformation: low vs. high) \times 2 (embedding: no-embedding vs. embedding) \times 2 (product contextuality: noncontextual vs. contextual) between-subject design. Participants were randomly assigned to one of the eight webstores. Participants in the noncontextual condition had to choose among desserts (the same products as the previous studies), whereas participants in the contextual condition had to choose among different furniture items (arm-chairs). Furthermore, to compensate for the fact that the 3D models that participants saw were not placed in front of them in their real environment, we manipulated the ability of AR to embed virtual content into real-environments (see web Appendix B in Supplementary Material). We manipulated a no-embedding condition using 3D models on a white background, whereas the embedding condition received the 3D models embedded in a realistic environment. For the embedding food conditions, participants saw the desserts placed on a table that was designed as in a restaurant. For the embedding furniture condition, participants saw different furniture (chairs) placed in a living-room. We manipulated imagery transformation as in Study 2.

Measures

We employed the same constructs and manipulation checks as in previous studies. Processing fluency of mental imagery was measured with a one-item scale “How would you describe the process of imagining how the dessert would look like” on a seven-point Likert scale (1 = “extremely difficulty” to 7 = “extremely easy”). Decision comfort ($\alpha = .79$) and WOM ($\alpha = .96$) were measured with the same constructs as in previous studies.

Manipulation Checks

We used the same manipulation check to test our imagery transformation manipulation and found significant differences between the two groups in line with expectations ($M_{\text{transformation High}} = 5.61$ vs. $M_{\text{transformation Low}} = 4.49$, $t(212) = 6.365$, $p < .001$). To measure the embedding manipulation, we borrowed Hilken et al. (2017)’s embedding construct ($\alpha = .82$) asking participants “The website showed me the product in the context in which the product would be consumed” and “The website showed me the product in the real environment in which it would normally be consumed” using seven-point Likert scales (“strongly disagree” = 1 to “strongly agree” = 7). Participants in the embedding condition experienced significantly higher embedding of the products than participants in the no-

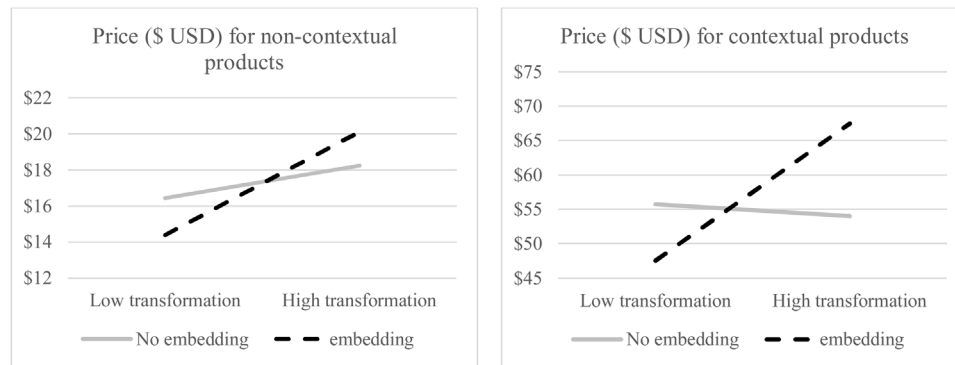


Fig. 5. Study 3 – interaction effects of transformation and embedding for noncontextual and contextual products.

embedding condition ($M_{\text{embedding}} = 5.40$, $M_{\text{no-embedding}} = 3.79$, $t(212) = 7.444$, $p < .001$).

Moderated-mediation Analysis

We used PROCESS v3.0 to construct a custom model to test our hypotheses. In the context of the online decision-making task, we find a significant main-effect of imagery transformation ($\beta = 1.022$, $p < .001$) and product contextuality ($\beta = -1.502$, $p < .001$) on processing fluency, indicating that contextual products are more difficult to imagine than noncontextual products. We also find a negative main effect of product contextuality on decision comfort ($\beta = -1.832$, $p < .001$). Importantly, we find a significant three-way interaction between embedding, imagery transformation and product contextuality ($\beta = -1.321$, $p = .019$) on processing fluency. This finding replicates previous research and highlights that embedding AR positively stimulates customer processing fluency. Further, H5 is supported as we find a significant interaction effect of our first mediator processing fluency and product contextuality on the sequential mediator decision comfort ($\beta = .244$, $p = .005$); while decision comfort is the only significant predictor of WOM ($\beta = .834$, $p < .01$) providing additional evidence for H3.

To test for conditional effects, we bootstrapped our sample using PROCESS v3.0. We find a significant indirect effect for imagery transformation on processing fluency for the nonembedding condition, however the effect is much stronger for contextual products when embedding is absent. When embedding is present, the effect of imagery transformation is not significant for product contextuality (noncontextual $p = .08$, contextual $p = .510$). In a similar manner, we calculated the indirect effects of embedding on processing fluency given the values of the two other moderators, indicating that embedding has a stronger significant effect for contextual products when imagery transformation is low. When imagery transformation is high, the effect of embedding for noncontextual products is insignificant, whereas the effect on contextual products is marginally significant ($p = .053$) (see web Appendix H in Supplementary Material). In the moderated sequential-mediation, the conditional effects show that processing fluency leads to a significant increase in decision comfort for contextual prod-

ucts ($IE = .239$, $p < .001$) but not for noncontextual products ($IE = -0.002$, $p = .972$).

Corollary Choice Analysis

We regressed imagery transformation, embedding, product contextuality and all interactions on product price. A significant main effect for imagery transformation ($F(1,206) = 5.523$, $p < .05$, Eta-squared = .026) and product contextuality ($F(1,206) = 201.753$, $p < .001$, Eta-squared = .495) and interaction effect between imagery transformation, embedding and product contextuality ($F(1,206) = 5.448$, $p < .05$, Eta-squared = .026) is evidenced. Interestingly, we see a stronger effect of transformation for embedded products at any level of contextuality. [Refer to web Appendix I (in Supplementary Material) for means and contrasts (Fig. 5).]

Discussion

Study 3 focused on contextual aspects of products. That is, how a product relates to other similarly functioned items in the customer's environment. Some products, such as furniture, are more dependent on the context for their evaluation (H5). A couch must match an existing décor, whereas a dessert is less dependent on other items on the menu. We found that contextual products benefit from AR-enabled retail frontline significantly more than noncontextual products. Our explanation for this effect hinges on processing fluency, where contextual products place a higher cognitive load on mental imagery during decision-making. To demonstrate this process, we again replicated H2 and H3 in an online retail frontline setting. Our results show that the AR-supported processing fluency and the resulting higher feeling of decision comfort drive WOM intentions. By introducing the boundary condition of contextual products (H5), we extended the underlying process of AR-enabled frontline to specific product types. Consistent with Hilken et al. (2017), embedding was replicated in our context as a necessary condition of AR-retail frontline. Also, we show that for any type of product (noncontextual vs. contextual), high imagery transformation and embedding lead to the highest price for chosen products.

Study 4: Note on Replicating Previous Studies to Control for Novelty Effects

In Studies 2 and 3 we established two important boundary conditions from a customer (processing style) as well as product (contextuality) perspective. To further strengthen our findings and control for novelty effects of AR technologies in retail frontline interactions, we replicated a combination of those studies with participants who previously had interacted with AR applications (Venkatesh, Thong, and Xu 2012). In the replication Study 4, which is described in full in the web Appendix J (in Supplementary Material), we recruited an MTurk sample of participants that had previously interacted with AR. We followed a similar design as in Study 2 and created 3 different web-stores based on our 2 (AR transformation: low vs. high) \times 2 (product contextuality: noncontextual vs. contextual) between-subject design. The results, which are summarised in Table 3, replicate the findings from Study 2 with a sample that had previous AR experience. Importantly, we also replicate results found in Study 3 given that we found a significant interaction effect of our first mediator processing fluency and product contextuality on the sequential mediator decision comfort, while decision comfort is the only significant predictor of WOM providing additional evidence for H3.

Study 5 (Field Study): AR and Its Impact on Consumer Choice and Spending

An important question that has evaded prior research on AR retailing is whether the experimental findings like those of our four prior studies hold in a real-world scenario. To address this question, we developed a field study. Study 5 focuses on external validity of our results using an existing AR application available from a large online retailer.

Participants and Design

We recruited 158 MTurk participants from the US who were currently interested in buying plush toys for themselves or as a present and had a mobile device (phone or tablet) with internet connection available. Participants were instructed to download the “Amazon Shopping App” on their mobile device, which was available in the Android and Apple app store at the time of the study. Our sample consisted primarily of phone users (91.8%) using Android (59.5%) and Apple (38.6%) as their operating system and matched a demographic audience that we expected to be interested in buying plush toys (64% female, mean age 36.83). All participants indicated English as their first language, while 98.1% indicated their country of birth as the USA. Given the perceived complexity of the study to download, install and use an AR application, we compensated participants with USD \$3 plus up to USD \$2 bonus that was used to measure personal spending in the experiment.

Materials and Procedure

Throughout, participants were asked to take screenshots of their phone, which they uploaded at the end of the survey as proof that the application was installed and used correctly. The application allows a customer to browse products via the Amazon website (control condition). It also offers an “AR View” for specific products from the Amazon webstore (AR condition). Using a between-subject design for each condition, participants received instructions on how to search for and view five different plush toys available for sale on Amazon at the time of the study. The plush toys and their prices were the same in both conditions and participants saw the products in a randomized order. In the AR condition, participants were able to project a hologram of each plush toy in their personal environment (e.g., desk or floor) and uploaded a screenshot of each AR product that they viewed. In the control condition, participants were instructed to view the product via a website accessed within the application and upload the screenshots of each product from their mobile devices. After viewing all five products, participants were asked to choose one of the products. The products ranged in price from USD \$9.49 to USD \$23.99. Following the participant’s choice, they were told that they could win the plush toy that they selected by spending parts of their bonus on lottery tickets. Participants could choose to buy between 0–15 lottery tickets that impacted their winning chance from 0–7.5%. The amount of tickets to buy was selected using a slider in the survey that presented participants with their expected winning chance and the amount of their bonus that they would spend for the given amount of tickets. The price of tickets depended on the value of the chosen product. This ensured that the expected value of bids was equal for all participants whether they chose an expensive or cheaper product (e.g., buying 15 tickets to win the \$9.45 plush toy would cost \$0.71 whereas 15 tickets to win a \$23.99 plush toy would cost \$1.80). After indicating how many (if any) tickets participants wanted to buy, they were instructed to upload the screenshots taken during the survey and were debriefed. We measured the following retailer-relevant variables: (i) if participants engaged in a choice or not; (ii) if so, the value of the chosen product (in USD); (iii) how committed to getting the product they were by the number of tickets purchased; (iv) what their willingness to spend was by the total value of tickets purchased.

Analysis

A multivariate generalized linear model with the manipulation (control $n=76$ vs. AR $n=82$) as our independent variable was used to measure the effect on our dependent variables; while controlling for age, gender, the operating system and device type (phone vs. tablet). None of the control variables had a significant effect on any of the dependent measures. Participants in the AR View condition chose higher value products (USD) than participants in the control condition (Mean_{Control} = 11.31 vs. Mean_{AR} = 12.61; $p=.056$), bought significantly more tickets (Mean_{Control} = 2.87 vs. Mean_{AR} = 4.28; $p=.020$), and had a higher spending on the tickets they bought (Mean_{Control} = .17 vs. Mean_{AR} = .27; $p=.013$). To test the difference in the pro-

portion of participants who buy (or do not buy) tickets we use a binary logistic regression with the same variables as previously mentioned. Again, none of the control variables emerge as significant while the AR View condition significantly predicts the dependent variable ($b = 1.490$, $p < .001$, $\text{Mean}_{\text{Control}} = .57$ vs. $\text{Mean}_{\text{AR}} = .85$; $p < .001$).

Discussion

In addition to the long-term reputation effects of the WOM explored in our earlier studies, retailers must be convinced that long-term investments in new frontline technology are consistent with near-term revenue goals. We show that, because of the AR frontline, customers are more likely to (i) choose a product; (ii) choose a more expensive product; (iii) are more committed to go through with the purchase by increasing their chances of obtaining the product; and, (iv) are willing to spend more overall. These results complement our laboratory findings and confirm the corollary results we observed in Studies 1–4.

General Discussion

Theoretical Implications

Five experiments conducted across two distinct frontline retail channels (restaurants and web-stores) using existing AR applications illustrate how the joint affordance of imagery generation and transformation is a key benefit of an AR-enabled retail frontline. We show this can significantly increase customers' willingness to share frontline experiences via positive WOM and how it improves choice. Our theorising posits that by allowing customers to offload a substantial part of cognitive tasks involved in purchase decisions, customers gain a sense of processing ease and decision comfort. In Study 1, we show a direct and positive association between an AR-enabled frontline and customers' WOM intentions. In addition, we find that the benefit of AR can be explained by the increased processing fluency of mental imagery. This type of processing fluency is chained in a sequential mediation process with customer decision comfort. The explicit association between mental imagery and decision comfort has been identified as a pertinent factor in our studies, which contributes to the literature about consumer-retailer interactions (Spake et al. 2003). In our case, this association holds irrespective of the decision outcome, which illustrates the importance of AR-enabled frontline for a retailer's reputation. Our findings support the notion that mental imagery is critical to marketing in hyper-connected markets (Parker, Lehmann, and Xie 2016; Spake et al. 2003) affecting both the long-term reputational effects of WOM and the near-term choice objectives through improved processing fluency and decision comfort.

In Studies 2 and 3, we investigated two relevant frontline boundary conditions; customer processing style and product contextuality. Study 2 compared two groups of customers, those dominant in spatial vs. object visualising abilities. Intriguingly, spatial visualisers benefit less from AR-induced mental transformation processes than object visualisers. This expands findings reported in Hilken et al. (2017), who showed that visualis-

ers in general benefited less from AR in a retail context than verbalisers. Our research contributes to the growing body of evidence, that offloading of mental processes to AR frontline technology benefits those with less ability to cognitively process aspects of visual information (Yoo and Kim 2014). In Study 3, we investigate product contextuality. The effect of processing fluency on decision comfort was stronger for customers who had to make a choice among contextual products. Conceptually, contextuality increases the load on mental imagery during decision-making. Consequently, an AR-enabled retail frontline, which helps ease that load, becomes relevant for retailing contextual products. By extension, product categories that demand more holistic, first-hand information to assess their value may benefit more from offloading mental imagery processes through AR (Weathers, Sharma, and Wood 2007). From a theoretical perspective this is an important caveat, suggesting that the benefits of AR-enabled retail frontline likely interact according to a retail context. Study 4 replicated the results of Studies 2 and 3 using a sample of participants who previously had AR experience. This buffers our findings controlling for “the shiny object syndrome”. Finally, Study 5 created a field experiment to test the effect of AR-enabled retail frontline on choice and consumer spending.

Implications for Retailers

In a hyper-connected marketplace, restaurateurs, for example, seek ways to influence consumer choice but also improve customers' WOM intentions (Litvin, Goldsmith, and Pan 2008). Just as with restaurants, many products sold online will be evaluated primarily by shared experiences (Rose et al. 2012). Results of our Field Study 5 show that for web-stores, the utilization of AR facilitates consumer choice.

By providing customers with AR experiences that allow them to offload mental imagery processing and see what products will look like in their own environment; the AR-enabled retail frontline creates feelings of fluency in a decision process (Janakiraman, Syrdal, and Freling 2016). As the pace of technology is quickly making functional concerns obsolete, the persistent managerial challenges are at the customer level. Our findings clearly show that to achieve processing fluency retail managers must align the AR-enabled frontline with the way that customers process mental imagery during decision-making. This necessitates conjunction between imagery generation and transformation. Since traditional marketing models have overlooked mental imagery and its impact on choice and WOM intentions; we highlight its central role in an AR-enabled retail frontline.

Not all customers respond equally to AR-enabled frontline; and not all products derive the same benefit from AR-based retailing. Specifically understanding the customer fit is important. We find that AR-supported mental imagery had the biggest impact on customers who are so-called object-visualisers. These customers focus mental imagery on properties of an object (e.g., shape or colour) to the exclusion of its location or spatial relations. The unique affordance of AR is its ability to supplement location and spatial orientation, which offloads much of the mental processing to the technology. Importantly, spatial-visualisers,

who were well predisposed to mentally imagine location and spatial relations of products, did not respond negatively to AR frontline. This means AR frontline is a net booster of retail experience. Nonetheless, retailers should consider segmentation in the context of AR-enabled retailing as part of a drive towards personalized frontline experience, that can take AR retailing beyond its current applications (Grewal, Roggeveen, and Nordfält 2017; Rafaeli et al. 2017).

Similarly, understanding the product fit can improve application of an AR-enabled retail frontline. Some products (e.g., furniture, clothes) demand an evaluation context. We show that contextual products benefit the most from AR. This is because mental imagery involved in modelling spatial aspects of the environment can be effectively and efficiently (i.e., with high processing fluency) emulated by the affordances of AR technology. Again, the AR frontline is an enabler, boosting customers' processing fluency of contextual products more than that of non-contextual products. Retailers of contextual products may see greatest returns to their investment in an AR-enabled frontline when combining near-term benefits, such as consumer choice, with long-term reputation building via WOM intention.

Limitations and Future Research

Participants in our studies were either digital natives or highly familiar with online-shopping environments. While these participants fit the target group of many AR applications, future research might investigate how age and channel experience affect channel integration (Verhoef et al. 2010). Further, we find consistent effects of imagery transformation across our studies, but we limited the range of transformations by conceptualizing imagery transformation as rotating and resizing of AR content. Future research might contribute to personalization of experiences during decision-making by studying an expanded range of AR transformations.

We focused on visual mental imagery, but other sensory modalities such as auditory, olfactory, gustatory and tactile might be offloaded on AR devices. Combining existing research on sensory marketing (Krishna and Schwarz 2014) with mental imagery theories (Lee and Gretzel 2012; Schifferstein 2009) would enlighten the field and holds the potential for important theoretical and managerial implications in the context of emerging technologies at the retail frontline. Similarly, as Schlosser (2006) indicated, adaption of AR technologies is crucial for retailer's success. While there is some evidence of what drives AR adoption (Venkatesh, Thong, and Xu 2012), adoption specific to different retailers (industry and product categories) and channels (offline vs. online) has not been studied.

Finally, our results compare the effects of offloading visual mental imagery affordances on AR-enabled devices compared to traditional methods of product presentation (e.g., menus, websites with pictures), but research has not confirmed if AR can substitute real products. Due to AR's unique transformability, product inspection in an AR-enabled retail frontline could potentially provide more detailed information than inspection of physical products. Further, managers should consider how AR is changing the retail frontline for their employees to successfully

manage augmented frontline personal-customer interactions and how AR can be used to vertically integrate existing sales channels (de Ruyter, Keeling, and Ngo 2018).

In sum, AR is no longer confined to science fiction, yet our understanding of its retail potential is only emerging. The potential is to bridge traditional and emerging retail channels, allowing for 'smarter' omni-channel strategies. Redefining the customer experience on the retail frontline, integrating digital, augmented, and physical elements in their customers' journeys and supporting better informed decisions are key ingredients to achieve competitive advantage that retailers need today and in the years to come. If AR is the future of retail frontline, then the future is here.

Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at doi:<https://doi.org/10.1016/j.jretai.2019.03.005>.

References

- Azuma, Ronald T. (1997), "A Survey of Augmented Reality," *Presence-Teleoperators and Virtual Environments*, 6 (4), 355–85.
- Babin, Laurie A. and Alvin C. Burns (1997), "Effects of Print Ad Pictures and Copy Containing Instructions to Imagine on Mental Imagery That Mediates Attitudes," *Journal of Advertising*, 26 (3), 33–44.
- Bar, Moshe (2007), "The Proactive Brain: Using Analogies and Associations to Generate Predictions," *Trends in Cognitive Sciences*, 11 (7), 280–9.
- Beaty, Roger E., Mathias Benedek, Paul J. Silvia and Daniel L. Schacter (2016), "Creative Cognition and Brain Network Dynamics," *Trends in Cognitive Sciences*, 20 (2), 87–95.
- Berger, Jonah and Katherine L. Milkman (2018), "What Makes Online Content Viral?," *Journal of Marketing Research*, 49 (2), 192–205.
- Chakravorti, Bhaskar (2004), "The New Rules for Bringing Innovations to Market," *Harvard Business Review*, 82 (3), 58–67 126
- Collins, David W. and Doreen Kimura (1997), "A Large Sex Difference on a Two-Dimensional Mental Rotation Task," *Behavioral Neuroscience*, 111 (4), 845–9.
- Compeau, Larry D., Dhruv Grewal and Kent B. Monroe (1998), "Role of Prior Affect and Sensory Cues on Consumers' Affective and Cognitive Responses and Overall Perceptions of Quality," *Journal of Business Research*, 42 (3), 295–308.
- Dacko, Scott G. (2017), "Enabling smart retail settings via mobile augmented reality shopping apps," *Technological Forecasting and Social Change*, 124, 243–56.
- Dahl, Darren W. and Steve Hoeffler (2004), "Visualizing the Self: Exploring the Potential Benefits and Drawbacks for New Product Evaluation," *Journal of Product Innovation Management*, 21 (4), 259–67.
- de Ruyter, Ko, Debbie Isobel Keeling and Liem Viet Ngo (2018), "When Nothing Is What It Seems: A Digital Marketing Research Agenda," *Australasian Marketing Journal (AMJ)*, 26 (3), 199–203.
- Djordjevic, Jelena., Robert J. Zatorre, Micheal Petrides and Marilyn Jones-Gotman (2004), "The Mind's Nose: Effects of Odor and Visual Imagery on Odor Detection," *Psychological Science*, 15 (3), 143–8.
- Dror, Itiel and Stevan Harnad (2008), *Offloading Cognition onto Cognitive Technology*, John Benjamins Publishing.
- Escalas, Jennifer Edson (2004), "Narrative Processing: Building Consumer Connections to Brands," *Journal of Consumer Psychology*, 168–79.
- Escalas, Jennifer Edson and Mary Frances Luce (2004), "Understanding the Effects of Process-Focused Versus Outcome-Focused Thought in Response to Advertising," *Journal of Consumer Research*, 31 (2), 274–85.
- Fink, Charlie (2017), *Why Consumer Adoption of Vr and Ar Will Be Slow*, [Accessed 28 March 2018].

- Frick, A., W. Mohring and N.S. Newcombe (2014), "Development of Mental Transformation Abilities," *Trends in Cognitive Sciences*, 18 (10), 536–42.
- Grewal, Dhruv, Anne L. Roggeveen and Jens Nordfält (2017), "The Future of Retailing," *Journal of Retailing*, 93 (1), 1–6.
- Hassabis, Demis and Eleanor A. Maguire (2007), "Deconstructing Episodic Memory with Construction," *Trends in Cognitive Sciences*, 11 (7), 299–306.
- Hayes, Andrew F. (2017), *Introduction to Mediation, Moderation, and Conditional Process Analysis: A Regression-Based Approach*, Guilford Publications.
- Hetts, John J., David S. Boninger, David A. Armor, Gleicher Faith and Nathansov Ariel (2000), "The Influence of Anticipated Counterfactual Regret on Behavior," *Psychology and Marketing*, 17 (4), 345–68.
- Hilken, Tim, Ko de Ruyter, Mathew Chylinski, Dominik Mahr and Debbie I. Keeling (2017), "Augmenting the Eye of the Beholder: Exploring the Strategic Potential of Augmented Reality to Enhance Online Service Experiences," *Journal of the Academy of Marketing Science*, 45 (6), 884–905.
- Hirschman, Elizabeth C. (1984), "Experience Seeking: A Subjectivist Perspective of Consumption," *Journal of Business Research*, 12 (1), 115–36.
- Isley, Steven C., Robert Ketcham and Douglas J. Arent (2017), "Using Augmented Reality to Inform Consumer Choice and Lower Carbon Footprints," *Environmental Research Letters*, 12 (6), 064002.
- Janakiraman, Narayan, Holly A. Syrdal and Ryan Freling (2016), "The Effect of Return Policy Leniency on Consumer Purchase and Return Decisions: A Meta-Analytic Review," *Journal of Retailing*, 92 (2), 226–35.
- Joseph, Seb (2017), *How Ikea Is Using Augmented Reality*, [Accessed 28 March 2018].
- Keogh, Rebecca and Joel Pearson (2014), "The Sensory Strength of Voluntary Visual Imagery Predicts Visual Working Memory Capacity," *Journal of Visualized Experiments*, 14 (12), 7–7.
- Kirsh, David and Paul Maglio (1994), "On Distinguishing Epistemic from Pragmatic Action," *Cognitive Science*, 18 (4), 513–49.
- Kosslyn, Stephen M. (1975), "Information Representation in Visual Images," *Cognitive Psychology*, 7 (3), 341–70.
- Kosslyn, Stephen M., William L. Thompson and Giorgio Ganis (2006), *The Case for Mental Imagery*, Oxford University Press.
- Kozhevnikov, Maria, Stephen Kosslyn and Jennifer Shephard (2005), "Spatial Versus Object Visualizers: A New Characterization of Visual Cognitive Style," *Memory & Cognition*, 33 (4), 710–26.
- Krishna, Aradhna and Norbert Schwarz (2014), "Sensory marketing, embodiment, and grounded cognition: A review and introduction," *Journal of Consumer Psychology*, 24 (2), 159–68.
- Lee, Sangwon and Daniel W. Baack (2014), "Meaning or Sound? The Effects of Brand Name Fluency on Brand Recall and Willingness to Buy," *Journal of Promotion Management*, 20 (5), 521–36.
- Lee, Woojin and Ulrike Gretzel (2012), "Designing Persuasive Destination Websites: A Mental Imagery Processing Perspective," *Tourism Management*, 33 (5), 1270–80.
- Levine, David N., Joshua Warach and Martha Farah (1985), "Two Visual Systems in Mental Imagery Dissociation of 'What' and 'Where' in Imagery Disorders Due to Bilateral Posterior Cerebral Lesions," *Neurology*, 35 (7), 1010–10.
- Litvin, Stephen W., Ronald E. Goldsmith and Bing Pan (2008), "Electronic Word-of-Mouth in Hospitality and Tourism Management," *Tourism Management*, 29 (3), 458–68.
- Luce, Mary, Frances, James R. Bettman and John W. Payne (2001), "Emotional Decisions: Tradeoff Difficulty and Coping in Consumer Choice," *Monographs of the Journal of Consumer Research*, 1, 1–209.
- Lutz, Kathy A. and Richard J. Lutz (1978), "Imagery-Eliciting Strategies: Review and Implications of Research," *ACR North American Advances*.
- MacInnis, Deborah J. and Linda L. Price (1987), "The Role of Imagery in Information Processing: Review and Extensions," *Journal of Consumer Research*, 13 (4), 473–91.
- McAvinue, Laura P. and Ian H. Robertson (2008), "Measuring Motor Imagery Ability: A Review," *European Journal of Cognitive Psychology*, 20 (2), 232–51.
- Miller, Darryl W. and Michael Stoica (2016), "Comparing the Effects of a Photograph Versus Artistic Renditions of a Beach Scene in a Direct-Response Print Ad for a Caribbean Resort Island: A Mental Imagery Perspective," *Journal of Vacation Marketing*, 10 (1), 11–21.
- Morgan, Blake (2017), *3 Examples of How Augmented Reality Improves the Customer Experience*, [Accessed 28 March 2018].
- Namatame, Akira (2010), "Diffusion and Emergence in Social Networks," in *Intelligent Systems for Automated Learning and Adaptation: Emerging Trends and Applications* IGI Global, 231–47.
- Paivio, Allan (2013), *Imagery and Verbal Processes*, Psychology Press.
- Park, Jihye, Leslie Stoel and Sharron J. Lennon (2008), "Cognitive, Affective and Conative Responses to Visual Simulation: The Effects of Rotation in Online Product Presentation," *Journal of Consumer Behaviour*, 7 (1), 72–87.
- Parker, Jeffrey R., Donald R. Lehmann and Yi Xie (2016), "Decision Comfort," *Journal of Consumer Research*, 43 (1), 113–33.
- Pearson, Joel, R.L. Rademaker and F. Tong (2011), "Evaluating the Mind's Eye: The Metacognition of Visual Imagery," *Psychological Science*, 22 (12), 1535–42.
- Pearson, D.G., C. Deeprose, S.M. Wallace-Hadrill, S. Burnett Heyes and E.A. Holmes (2013), "Assessing Mental Imagery in Clinical Psychology: A Review of Imagery Measures and a Guiding Framework," *Clinical Psychology Review*, 33 (1), 1–23.
- Pearson, J., T. Naselaris, E.A. Holmes and S.M. Kosslyn (2015), "Mental Imagery: Functional Mechanisms and Clinical Applications," *Trends in Cognitive Sciences*, 19 (10), 590–602.
- Pérez-Fabello, María José, Alfredo Campos and JuanCarlos Meana (2014), "Vividness and Control of Mental Imagery and the Components of in-Depth Drawing," *Creativity Research Journal*, 26 (2), 244–7.
- Petrova, Petia K. and Robert B. Cialdini (2008), "Evoking the Imagination as a Strategy of Influence," in *Handbook of consumer psychology* 505–24.
- Phillips, Diane M., Jerry C. Olson and Hans Baumgartner (1995), "Consumption Visions in Consumer Decision Making," *ACR North American Advances*.
- Rafaeli, Anat, Daniel Altman, Dwayne D. Gremier, Ming-Hui Huang, Dhruv Grewal, Bala Iyer, Ananthanarayanan Parasuraman and Ko de Ruyter (2017), "The Future of Frontline Research: Invited Commentaries," *Journal of Service Research*, 20 (1), 91–9.
- Rese, Alexandra, Daniel Baier, Andreas Geyer-Schulz and Stefanie Schreiber (2017), "How Augmented Reality Apps Are Accepted by Consumers: A Comparative Analysis Using Scales and Opinions," *Technological Forecasting and Social Change*, 124, 306–19.
- Rodríguez-Ardura, Inma and Francisco J. Martínez-López (2014), "Another Look at 'Being There' Experiences in Digital Media: Exploring Connections of Telepresence with Mental Imagery," *Computers in Human Behavior*, 30, 508–18.
- Roggeveen, Anne L., Dhruv Grewal, Claudia Townsend and R. Krishnan (2015), "The Impact of Dynamic Presentation Format on Consumer Preferences for Hedonic Products and Services," *Journal of Marketing*, 79 (6), 34–49.
- Rose, Susan, Moira Clark, Phillip Samouel and Neil Hair (2012), "Online Customer Experience in E-Retailing: An Empirical Model of Antecedents and Outcomes," *Journal of Retailing*, 88 (2), 308–22.
- Sauvageot, F., D. Hoang Nguyen and D. Valentin (2000), "Do Words Evoke Taste Feelings? A Comparison between French, American and Vietnamese Students," *Sciences des Aliments*, 20 (4–5), 491–522.
- Schiffman, Hendrik N.J. (2009), "Comparing Mental Imagery across the Sensory Modalities," *Imagination, Cognition and Personality*, 28 (4), 371–88.
- Schlosser, Ann E. (2006), "Learning through Virtual Product Experience: The Role of Imagery on True Versus False Memories," *Journal of Consumer Research*, 33 (3), 377–83.
- (2003), "Experiencing Products in the Virtual World: The Role of Goal and Imagery in Influencing Attitudes Versus Purchase Intentions," *Journal of Consumer Research*, 30 (2), 184–98.
- Schubert, Thomas W. and Sander L. Koole (2009), "The Embodied Self: Making a Fist Enhances Men's Power-Related Self-Conceptions," *Journal of Experimental Social Psychology*, 45 (4), 828–34.
- Schwartz, Daniel L. and Tamara Black (1999), "Inferences through Imagined Actions: Knowing by Simulated Doing," *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 25 (1), 116.
- Shugan, Steven M. (1980), "The Cost of Thinking," *Journal of Consumer Research*, 7 (2), 99–111.

- Simon, Herbert A. (1955), "A Behavioral Model of Rational Choice," *The Quarterly Journal of Economics*, 69 (1), 99–118.
- Spake, Deborah F., Sharon E. Beatty, Beverly K. Brockman and Tammy Neal Crutchfield (2003), "Consumer Comfort in Service Relationships: Measurement and Importance," *Journal of Service Research*, 5 (4), 316–32.
- Srivastava, Mala and Dimple Kaul (2014), "Social Interaction, Convenience and Customer Satisfaction: The Mediating Effect of Customer Experience," *Journal of Retailing and Consumer Services*, 21 (6), 1028–37.
- Sweeney, Jillian C., Douglas Hausknecht and Geoffrey N. Soutar (2000), "Cognitive Dissonance after Purchase: A Multidimensional Scale," *Psychology and Marketing*, 17 (5), 369–85.
- Venkatesh, Viswanath, James Y.L. Thong and Xu Xin (2012), "Consumer Acceptance and Use of Information Technology: Extending the Unified Theory of Acceptance and Use of Technology," *MIS Quarterly*, 157–78.
- Verstijnen, Ilse M., Cees van Leeuwen, G. Goldschmidt, R. Hamel and J.M. Hennessey (1998), "Creative Discovery in Imagery and Perception: Combining Is Relatively Easy, Restructuring Takes a Sketch," *Acta Psychologica*, 99 (2), 177–200.
- Verhoef, P.C., R. Venkatesan, L. Mcalister, E.C. Malthouse, M. Krafft and S. Ganesan (2010), "CRM in Data-Rich Multichannel Retailing Environments: A Review and Future Research Directions," *Journal of Interactive Marketing*, 24, 121–37.
- Vijayasarathy, Leo R. (2004), "Predicting Consumer Intentions to Use on-Line Shopping: The Case for an Augmented Technology Acceptance Model," *Information & Management*, 41 (6), 747–62.
- Wänke, Michaela, Gerd Bohner and Andreas Jurkowsch (1997), "There Are Many Reasons to Drive a Bmw: Does Imagined Ease of Argument Generation Influence Attitudes?," *Journal of Consumer Research*, 24 (2), 170–8.
- Weathers, Danny, Subhash Sharma and Stacy L. Wood (2007), "Effects of Online Communication Practices on Consumer Perceptions of Performance Uncertainty for Search and Experience Goods," *Journal of Retailing*, 83 (4), 393–401.
- Yoo, Jungmin and Minjeong Kim (2014), "The Effects of Online Product Presentation on Consumer Responses: A Mental Imagery Perspective," *Journal of Business Research*, 67 (11), 2464–72.
- Zatorre, Robert J. (1999), "Brain Imaging Studies of Musical Perception and Musical Imagery," *Journal of New Music Research*, 28 (3), 229–36.
- Zeithaml, Valerie A., Leonard L. Berry and A. Parasuraman (1996), "The Behavioral Consequences of Service Quality," *Journal of Marketing*, 60 (2), 31–46.
- Zhao, Min, Steve Hoeffler and Gal Zauberman (2011), "Mental Simulation and Product Evaluation: The Affective and Cognitive Dimensions of Process Versus Outcome Simulation," *Journal of Marketing Research*, 48 (5), 827–39.
- Zhu, Zhen, Cheryl Nakata, K. Sivakumar and Dhruv Grewal (2007), "Self-Service Technology Effectiveness: The Role of Design Features and Individual Traits," *Journal of the Academy of Marketing Science*, 35 (4), 492–506.